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A

DATA PROCESSING DIGEST

A SERVICE OF
CANNING
SISSON AND
ASSOCIATES

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Harvard Business Review, January-February, 1955; Pages 77-88

"Economics of the Digital Computer," • by Richard F. Clippinger, Raytheon Manufacturing Co.

Four questions which a business man might ask himself when he begins to consider the use of automatic data-processing equipment are:

- "(1) What records and problems do I have to which a digital computer can be advantageously applied?
- "(2) Will a digital computer lower my cost?
- "(3) Should I set up my own installation, or should I farm out my problems to a computing center?
- "(4) What scale of operation fits my company?"

The criteria for applicability of automatic data-processing equipment are "a) it must be possible to obtain a well-defined procedure for execution of the solution no matter how complicated, and b) there should be some saving in cost or time over other methods."

Three potential uses are discussed in the order of their immediate potentials: Record Keeping, Management Decision, and Industrial Research.

Record Keeping

Record Keeping is the most important immediate field for digital computers with auxiliary memory. An example given is the problem of continuous inventory. Such a problem might require 20 man-years of preparation for the computer, since every exception to the usual procedure must be taken into consideration. But eventually the clerical staff might be reduced from 150 to 50, the output of the manufacturing division might increase by 10% to 30% without an increase in cost, and management would have a current picture of the status of the business rather than getting reports weeks later.

Management Decision

Management decision problems are representative of a type which involves more machine computation and less input data than record keeping problems, but which can result in even greater increased efficiency. In many cases a high-speed computer and mechanized record keeping are a prerequisite for full use of such methods.

Industrial Research

Industrial research problems can use whatever remaining time is available to great advantage, in development of new products.

Cost of Computers

The capacity of a computer is measured in terms of manpower, and cost is given in dollars per man-year. The cost per man-year tends to decrease as the cost of the computer increases (since the manpower capacity tends to increase faster than the cost of the computer).

Speed

More detailed programming may produce faster computing results. However, if the machine is too small for the problem and it is solved in pieces, computing time will be increased. The computer which is large enough to handle the most complex job will prove to be the wiser choice.

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Cost of Staff

The staff for the computer may actually cost more than the computing installation, for the computer's instructions all have to be written originally by human beings. Sometimes savings result from the possibility of using the same code for different computer installations, or for different divisions within the company.

Peripheral Equipment

The cost of peripheral equipment may be the largest one in some business applications, because of the great quantity of input-output data.

The following are some ways in which the individual company can make advantageous use of the digital computer:

Opportunities for Savings

- 1) Clerical work may be reduced by use of the automatic business machine. This alone may pay for a large installation.
- 2) Inventory can be reduced through more accurate up-to-date information. In some cases these savings may be much more important than the reduced cost of clerical work.
- 3) Work loads can be made smoother in the manufacture of complicated products, thus making it possible for the same number of people to produce more.

4) Sales analyses, with continuous, up-to-date detailed information statistically evaluated, will make it possible to distribute sales activity more efficiently, thereby increasing sales and reducing cost again.

5) Research can be improved and accelerated, thus leading to reduced cost of production of old products and creation of new and better products.

Central Laboratories

Central computing laboratories can help companies evaluate their problems and needs, or do their data-processing jobs for them. This latter move may be an economical one for a smaller company to make.

Conclusion

"In the next decade automatic computers can be expected to work their way into all phases of business, to reverse the trend toward high overhead and reams of paper work, to lead to new efficiency and new products."

Included are examples of the use of data-processing equipment in a casualty insurance company and a retail chain, and detailed information about available electronic computers and their possible uses.

"Automation of Bank Operating Procedure,"

a booklet published by the American Bankers Association, 1955.

The American Bankers Association is attempting to bring together the bankers and the makers of electronic data processing equipment to study the common record keeping and transaction problems of banks.

The Association believes that entirely new concepts of business methods must be developed in order to successfully use electronic methods.

Banking data processing problems divide into two parts: Savings operations, in which unified action among all savings organizations is called for, but for which diversified equipment is needed to suit the individual needs; and checking operations, in which similar features would be required in all equipment provided by business machine manufacturers, since most of the checking operations are an inter-bank function.

Two criteria are necessary for check operations:

- 1) There must be a common language for all check transaction; 2) uniformity of check design is essential, but not complete standardization.

Two other considerations are necessary:

- 3) Experiments should be continued toward using a carrier other than the check; 4) consideration should be given toward combining the check and sensing or character recognition (e.g. perforations, magnetized spots, etc.) on the same carrier.





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The American Bankers Association recommends:

1. Physical characteristics of checks should be restricted.
2. Data should be carried in specified areas in a common code.
3. Equipment should be small, and use common techniques.
4. Prompt action.

Recommendations for savings account operation:

1. Continued use of pass book, deposit and withdrawal slips.
2. Provide automatic processing of transaction, automatic calculating and auditing.

ILLINOIS CERTIFIED PUBLIC ACCOUNTANT, December, 1954; Pages 1-4. "An introduction to electronic accounting." Brief, elementary, easily understood description of the use of electronic equipment in accounting. Includes a very simple example of use of common-language equipment in sales order processing.

INSTRUMENTS AND AUTOMATION, January, 1955; Page 115. "Fashion merchandise control," abstracted from The Department Store Economist, 100 E. 42nd St., New York 17, N.Y.

THE OFFICE, January, 1955. The entire issue is given to brief articles about office procedures and new equipment. Among those having something of interest to say about electronic equipment and methods are the following:

"Office needs more complex computers than does science," Page 82. There are three factors facing users of electronic equipment in business applications: 1) there must be extensive programming, 2) there is not yet adequate input-output equipment, 3) entirely new procedures must be devised.

"Why the 'automatic office' is still some years off," Page 84. Neither business nor the manufacturers, have yet completely solved the problem of data-gathering for computer use, although eventually, electronics may reduce the clerical work week to 20 hours.

"Railroads standardizing paper work for automation," Page 91. There is an increasing demand among railroads for automation of information production.

"Electronics processors in the insurance industry," Page 112. The insurance industry is carrying on an active program of investigation and experiment in the use of electronic equipment.

"Simplify your routines to prepare for electronics," Page 114. Businesses are urged to survey present procedures, simplify them, and look forward to using electronics methods as equipment becomes available.

U. S. NEWS AND WORLD REPORT, February 11, 1955; Pages 50, 51. American production methods are bringing electronic computing equipment within reach of more businesses, pointing the way to a new revolution in the business world.

DUN'S REVIEW, February, 1955; Pages 98 - 100. "Here and there in business." Electronic computers are now being used by a number of Government agencies and businesses and are proving their usefulness.

AMERICAN BUSINESS, February, 1955; Pages 22-24, 41. "Facts for Management: is 1955 the year for EDP?" Highlights of 1954 electronic achievements are listed, including products of seven companies, and the new components and electronic parts, such as magnetic core memories and transistors. Careful planning and new methods are needed to properly utilize electronic equipment. Otherwise it will merely speed up the confusion.

BUSINESS WEEK, March 5, 1955; Page 84. Don G. Mitchell, President of Sylvania Electric Products, Inc., speaking at American Management Association, said that electronics networks in business will not nullify the trend toward decentralized authority.

THE OFFICE, March, 1955; Pages 7-19. "Greatest electronics expansion to be in office mechanization." Automatic data handling is becoming more widespread in business and is expected to ease the rising costs of clerical help and make more efficient use of employees.

STEEL, January 24, 1955; Page 37.* Lack of adequate input-output equipment and small-sized computers have hampered widespread use of automatic data processing.



Applications

AUTOMATION, December, 1954; Pages 31-39

*"Integrated Data Processing Brings Automation In Paperwork," by P. B. Garrot,
Director of Market Development, Standard Register Company, Dayton, Ohio*

PART 1 OF THREE PARTS

People need written instructions and directions to do a job, but such needs "may devour ten per cent or more of the sales dollar."

One way in which paper work may be reduced to its barest essentials is through the use of "integrated data processing," or the mechanizing of business paper work. This would result in reducing danger of human error by reducing human participation; and would furnish information when and where it is needed more quickly.

Integrated data processing allows the transfer of information among business machines, and the production of information in a form for human consumption by use of a punched paper tape which all components of the data processing system can read and use. This "common language tape" is one which conforms to the 5-channel communications code, and which can also be read and used by the Teletypewriter. The following business machines have been equipped to use the common language tape:

- 1) The electric typewriter, for punching, reproducing, reading tape.
- 2) The ten-key adding machine for punching.
- 3) Embossed metal address plate machines, for preparing address plates.
- 4) Bookkeeping machine to punch tape while printing results.
- 5) Cash register, which can punch tape while recording transactions.
- 6) A large desk calculator linked with tape-punching and reading unit and a typewriter.
- 7) Punched card equipment can be made a part of the system through the use of translating units.

The two basic rules for achieving integrated data-processing are:

"(1) Record data at the point of origin on office machines which create punched tapes or cards as the automatic by-product of the recording operation.

"(2) Process original and subsequent data on office machines which read and punch tapes or cards, so that all data are self-perpetuating."

PART 2 OF THREE PARTS

AUTOMATION, January, 1955; Pages 39-44

An example of the process described in Part 1 is the purchasing-receiving operation in a widely scattered industrial organization. The procedure for replenishing of a purchased stock item might be:

- 1) A parts card is typed on a "common language" machine, which simultaneously punches a paper tape.
- 2) The paper tape is used to copy part information onto a requisition form, and a requisition tape is punched.
- 3) The Purchasing Department uses the requisition tape to type requests for quotations, adding additional information manually, and punching new tape.

In a decentralized organization, a Teletypewriter may perform these steps.

- 4) By using the Teletypewriter, both the Material Control and Receiving Departments will receive a copy of the purchase order on their own forms, as it is typed out in the Purchasing Department. The Receiving Teletypewriter is also producing a punched paper tape.

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- 5) As the order is received, Receiving's paper tape types out partial receiving reports for Inventory Control and Purchasing Departments.
- 6) Punched cards could be made by the Receiving tapes for Accounting.

Other by-product uses of the punched tapes could be:

- 1) Automatic typing
- 2) Wire transmission
- 3) Preparation of metal address plates
- 4) Conversion to punched cards
- 5) Input into electronic computer systems.

PART 3 OF THREE PARTS

AUTOMATION, February, 1955; Pages 65-72

Integrated data processing should be considered a top management tool, since it concerns those systems which handle masses of data processed by many people, and involve numerous departments and functions.

Before a data processing system can be installed, the entire process must be analyzed. The procedure in its existing form and its proposed improved form

should be recorded on flow charts. Present and suggested forms should be included. The writing process should be scrutinized for replacement of manually produced records with common-language equipment. Forms should be designed to perform as an integrated part of each step (e.g. information which is needed in several departments should be contained in identical positions on the various forms).

Some methods of working with common language tapes are:

- 1) Errors in tapes may be corrected by obliterating or by re-punching on new tape.
- 2) Tapes should be filed, along with a copy of their associated forms.
- 3) In general, tapes should be destroyed when their information is contained in common language form elsewhere.
- 4) Identification may be punched or penciled on the tape. Different colors for the various functions help with quick identification.

Persons interested in studies in integrated data processing are invited to see and use the facilities of Standard Register Company's integrated data processing workshop.

A typical flow chart of a complete system, using the example of the inventory control problem is included.

"The Impact of Computers on Office Management,"

OFFICE MANAGEMENT SERIES PAMPHLET NO. 136, American Management Association, 1955

This pamphlet includes five technical papers which were presented at the Office Management Conference of the American Management Association held at the Hotel Astor, New York City, October 20-22, 1954. Three of the papers are included in the following abstract.

The Computer in Industry reports on experience at the General Electric Company, Louisville, Kentucky.

A. "Impact of the Computer on Methods," by W. W. Smith, Business Procedures Section. At Appliance Park, G. E.'s Major Appliance Division, the first business installation of a large scale computer system (Univac) has been completed, and is being ap-

plied in the four initial areas of payroll, material scheduling and inventory control, budgets, and marketing. A brief description is given of a master plan which will coordinate present and contemplated applications to permit maximum use of common input and output data; it involves decisions and planning necessary to effect a change in production output. It is felt that enough progress has already been made on the installation to provide convincing evidence that

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many of the aspects of the master plan may soon be accomplished.

B. "The Computer At Work On Payrolls," by Byron F. Burch, Jr., business procedures analyst. Payroll was selected as the first of the four initial applications to be converted to the Univac, primarily because of the expected transfer of operations from the Erie Works to Appliance Park and the resultant expected increase in the payroll operation. Each of the five product departments at Appliance Park had its own payroll system. Four groups worked on the plans for the payroll system: 1) a planning group of procedures analysts who surveyed the existing system and laid out plans for the new system; 2) a group involved with detailed computer programming; 3) a committee of experienced payroll people to represent the five departments; and 4) a committee of cost accountants, to approve the labor distribution part of the system.

Control techniques were established to assure that all documents were received from the five departments and information placed in the computer. To accomplish this control, documents are forwarded in batches with control totals for each batch.

A brief description is given of the new system, including the variety of job tickets used, the daily processing operation, weekly processing, and final computations.

G. E. found the areas to be watched include 1) an excess of programming procedural exceptions, which increase programming time, computer time, and available memory beyond the benefits gained; and 2) numerous variations of reports prepared from the same information, requiring excessive sorting operations.

Programming the Computer for Clerical Production. by A. C. Vanselow, Franklin Life Insurance Company. Franklin Life is a rapidly-growing medium-sized life insurance company, with approximately 400,000 policies and \$1 billion of ordinary life insurance in force. A Univac system has been selected to provide improved customer service, and the equipment was chosen because of the 1) alpha-numeric, 2) self-checking, and 3) high input-output features. All functions involving highly repetitive tasks were considered (such as premium billing, dividend ac-

counting, etc.) to make the installation economical. Assurance was given that all employees doing a good job would not be released by the company after the computer was installed; normal attrition would accomplish the transition.

Eleven company personnel were trained in computer programming, and the manufacturer provided additional experienced programmers. Four engineers and four technicians were hired for maintenance. An "operator technician" approach is being followed whereby the technicians would serve as operators as long as the computer is in operation. Also, a group of 10 persons will code and check all manual data in preparation for entry into the computer.

Following the initial training, a survey of the various departments was made. General flow charts were prepared. Next, programs were defined and assigned to programmers. Test items were prepared, to test all conditions of the programs.

A brief description is given of the system, including the make-up of unit records in the master file, premium billing, policy loans, payment of dividends, agency commissions, and miscellaneous operations. To enable the computer to process all the work mentioned, 50 programs are under development exclusive of sort and merge routines. The preparation of these programs will involve in excess of 20,000 man-hours of work.

Comments are made on proposed methods of acceptance testing and the change-over, or conversion, process. It is estimated that when all operations under consideration are converted, a personnel saving of at least 200 employees will be achieved.

The remainder of the booklet will be abstracted in the May issue.

AIEE TRANSACTIONS PAPER, February, 1955

"An Electronic System For Processing Air Traffic Control Information,"

by R. M. Kalb, Engineering Research Associates.

A common system for air traffic control has been developed for the Air Navigation Development Board, Civil Aeronautics Administration, by Engineering Research Associates (Division of Remington-Rand).

The Common System includes navigational aids, airborne equipment, and ground-based electronic aids. As a part of the ground-based aids there is provided a flight plan storage and processing equipment, consisting of a high-speed, unindexed, electronic filing system.

The system makes available to all flight control stations information on weather, flight plans, schedules, plane information, fuel, and other pertinent data. Routine processing of the information is done automatically, and all information is kept up to date. A punched tape is made of all changes in information

and can be used to prepare printed reports of any portion of the information file. The equipment consists of a magnetic drum storage, and a buffer register used to hold information being added to or extracted from the memory. The system accepts and prints out teletype messages.

Future plans include connecting of adjacent control zones by teletype for establishing interzone flight plans, and provision for adding time reservations for limiting scheduling of landings and take-offs. Facilities are now being developed to use electronics for attendant clerical procedures.

The full text of this paper may be obtained by writing the American Institute of Electrical Engineers, 33 West 39th Street, New York 18, N.Y. Ask for No. 55-147. The price is 30¢ to AIEE members, 60¢ to non-members.

AUTOMATIC CONTROL, January, 1955; Page 26

"A Magnetic Drum Speeds Stock Transactions,"

AUTOMATIC CONTROL, February, 1955; Pages 25, 26

"Magnetic Drums Store Plane Flight Data."

A magnetic drum built by Teleregister Corp. of New York City, is being used by the Toronto Stock Exchange and American Airlines.

In the stock exchange application, members' offices are connected by wire to the automatic equipment and monitor board at the Toronto Exchange. Brokers push a button to connect with an idle transmitter at the Exchange, then dial a 3-digit stock code number listed in a directory. The broker's ticker is operated by the transmitter, which receives the requested information from the electronic portion of the equipment at the rate of $4\frac{1}{2}$ quotations per second. The efficiency of the system depends on time sharing. Two hundred brokers and six operators use the single magnetic drum and its electronic controls. Similar systems for inventory control, but with different types of input-output equipment are being designed for four other important industries.

allows the reservations clerk to request information from the memory without its primary function of reservation control being disturbed.

AUTOMATIC CONTROL, January, 1955; Page 6.

"Electronic data transceiver hooks up plant and computer." General Electric uses a new electronic data transceiver to hook up three of its plants with IBM computing facilities in New York, and computing center in Cincinnati.

AUTOMATIC CONTROL, January, 1955; Page 11.

"Tolls collected with automatic control." Automatic devices installed at collection points on toll highways and bridges are speeding traffic, safeguarding collections, streamlining auditing, and catching violators.

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American Airlines is using similar equipment for reservations. An additional feature is FLIFLO which



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ELECTRONIC DESIGN, January, 1955; Page 9. "Computer determines low bidders." Method for using high speed electronic computers for determining low bids developed at National Bureau of Standards.

BUSINESS WEEK, March 5, 1955; Pages 132, 133. "Giving rail freight new pep." Chesapeake and Ohio Railroad is using Univac to simplify its freight revenue accounting procedures and its payroll operations. Others are using electronics for central traffic control.

AUTOMATION, March, 1955; Page 18. "Data-handling equipment—a must for patent processing." Secretary of Commerce Weeks says data processing equipment must soon replace present search methods in U. S. Patent Office in order to keep ahead of rapid increase in patents.

COMPUTERS AND AUTOMATION, March, 1955; Page 8.* "Computers and weather prediction." A description of the problems involved in weather prediction and the surmise that presently available computers are still ahead of available meteorological knowledge.

Equipment

AIEE CONFERENCE PAPER, February, 1955.

"A New Magnetic Memory Device For Business Machines,"

by S. J. Begun, Clevite-Brush Development Co.

In the TapeDRUM, developed by Clevite-Brush Development Company, all information is recorded on an endless magnetic tape 10 to 12 inches wide and 8 to 450 feet long. The tape hangs free over a horizontal rotating drum which contains a row of magnetic read and write heads. During operation a thin air cushion raises the tape from the drum surface. The tape is divided into "pages" for referencing information. A photoelectric control system selects the page called for by the program code, and the tape is braked to a stop when that portion of the tape called for is positioned over the top of the drum.

For random access purposes, both the tape and the drum can rotate in opposite directions until the information called for is found. The relative speeds of the tape and drum are such that the heads scan each page twice per drum revolution. Here are some descriptive figures of the device:

TAPE	DRUM
10 — 12 in. wide	12 in. dia.
8 — 450 ft. long	1200 rpm

Scanning speed: 1 in. per 1.33 ms. Page size: 200 sq. in., storage capacity 200,000 pulses. 16 pages per 50 ft. of tape (3 million bits). Page inspection time: 1/20 sec. Acceleration and deceleration of tape: 25 ms. Access to pages in sequence: 400 ms.

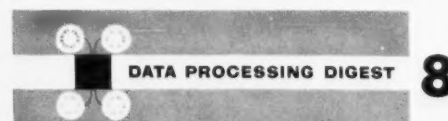
The full text of the paper may be obtained from the American Institute of Electrical Engineers, 33 West 39th Street, New York 18, N.Y. Ask for No. CP 55-243. Price is 30¢ to members of AIEE, 60¢ to non-members.

ELECTRONIC DESIGN, January, 1955; Page 15. "Small data processing computer." MINAC uses a magnetic tape capsule, claimed to be completely adequate for many small businesses.

ELECTRONIC DESIGN, January, 1955; Page 16. "Computer for refinery." Socony-Vacuum and affiliate, Magnolia Petroleum each installing Electro-Data computers.

FACTORY MANAGEMENT & MAINTENANCE, January, 1955; Page 151. "Ungobbling gobbledegook in your coded data." Stanomatic system automatically converts information from business forms which are printed with a code of dots at the same time they are prepared. (Manufactured by Standard Register Co.)

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BUSINESS WEEK, February 5, 1955; Pages 57, 58. "Electronics counts the stock." Announcement of NCR 303 computer system for department store sales and inventory data.

COMPUTERS AND AUTOMATION, March, 1955; Page 22.* "Components of automatic computing machinery—list of types." Five types of computing equipment with their characteristics are listed: 1) storage media, internal and external; 2) storage

media, internal only; 3) calculating and controlling devices; 4) input devices; 5) output devices.

COMPUTERS AND AUTOMATION, March, 1955; Page 24.* "Roster of organizations in the field of computers and automation." Supplement, information as of February 10, 1955.

DUN'S REVIEW, February, 1955; Pages 98-100. "Here and there in business: Electronic computers." A brief rundown of some electronic computers available and in use.

Programming

COMPUTERS AND AUTOMATION, February, 1955; Pages 27 and 33.* "Debugging computer programs." Suggestions for verifying a program before beginning the machine time.

Comment

While articles on the subject of automatic data processing are increasing in numbers and in value of content, a great majority are still of a fairly general nature and simply indicate the problems which are being analyzed. In abstracting such articles it is felt that only brief mention need be given. Articles and pamphlets are beginning to appear which contain considerably more specific information of interest to business management and the contents of these are abstracted more fully.

A number of special-purpose machines designed to provide real-time information processing (i.e., transactions are processed and files are up-dated as the transactions occur) are mentioned in this issue: for example, airline reservations, stock transaction system, and air control system. All of these use a magnetic drum to obtain the necessary volume of data storage, as well as the rapid access to information required in a real-time system. Business requirements for real-time computation have yet to be thoroughly explored; first because the cost per digit stored has been much higher in such memory systems, as compared with magnetic tapes; and second, many business operations do not, on the surface, seem to require this immediate processing.

The TapeDRUM unit is an attempt to bridge the gap between expensive random access memories which allow real-time processing and the slower standard tape system which forces one to a delayed-processing system (i.e., files are up-dated and processed a few hours or days after the transactions occur). The

Management Decisions

COMPUTERS AND AUTOMATION, March, 1955; Page 28.* "Computers make administrative decisions?" Use of computers to make government administrative decisions.

TapeDRUM unit allows reasonably rapid random access to some data, but slower access to a larger quantity with attendant cost savings over completely random access systems.

The work of the American Banking Association in establishing general data processing requirements in their field is a pioneering effort. A thorough study of requirements seems to be absolutely necessary in preparing for intelligent cost estimating and selection of automatic data processing equipment.

A natural result of a study of requirements is the recognition of the necessity for communicating data in a common machine language. (See: "Integrated Data Processing Brings Automation To Paper Work," Page 4-5.)

Although data processing involves other phases such as the rearrangement, computation, storage (filing), and display (printing) of data, any system would become unworkable if the units performing these functions could not communicate with each other by means of inexpensive conversion devices and communication systems. In fact, conversions whose only purpose is to match different coding systems or different information-carrying media (i.e. paper tape, magnetic tape, punched cards), result in more expensive and more costly systems.

References noted in this issue

American Bankers Association
12 East 36th Street
New York 16, N.Y.

American Business
4660 Ravenswood
Chicago 40, Illinois

American Institute of Electrical Engineers
33 West 39th Street
New York 18, N.Y.

American Management Association
330 West 42nd Street
New York 36, N.Y.

Automatic Control
430 Park Avenue
New York 22, N.Y.

Automation
Penton Building
Cleveland 13, Ohio

Business Week
330 West 42nd Street
New York 36, N.Y.

Computers and Automation
36 West 11th Street
New York 11, N.Y.

Dun's Review & Modern Industry
99 Church Street
New York 8, N.Y.

Electronic Design
19 East 62nd Street
New York 21, N.Y.

Factory Management & Maintenance
330 West 42nd Street
New York 36, N.Y.

Harvard Business Review
Soldiers Field Station
Boston 63, Mass.

Illinois Certified Public Accountant
208 South LaSalle Street
Chicago, Illinois

Instruments and Automation
845 Ridge Avenue
Pittsburgh, Pa.

The Office
270 Madison Avenue
New York 16, N.Y.

Steel
Penton Building
Cleveland 13, Ohio

U. S. News and World Report
24th and N. Sts., N.W.
Washington 7, D. C.

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